Uncovering the influence of commuters' perception on the reliability ratio

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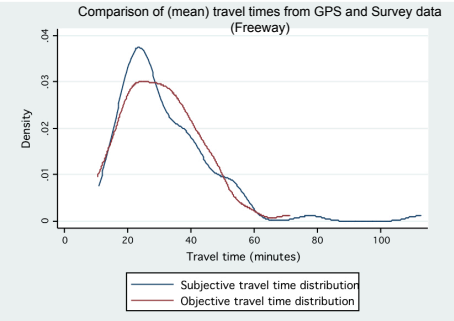
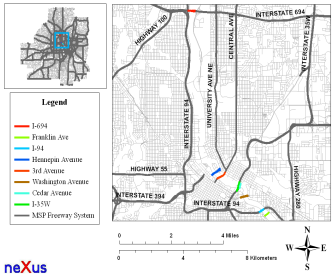
Abstract

The dominant method for measuring **values of travel time savings** (VOT), **and values of travel time reliability** (VOR) is discrete choice modeling. Generally, the data sources for these models are: stated choice experiments, and revealed preference observations. There are few studies using revealed preference data. These studies have only used travel times measured by devices such as loop detectors, and thus the perception error of travelers has been largely ignored. In this study, the influence of commuters' perception error is investigated on data collected of commuters recruited from previous research (Carrion and Levinson (2012), Zhu (2010)). The subjects' self-reported travel times from surveys, and the subjects' travel times measured by GPS devices were collected. The results indicate that the subjects reliability ratio is greater than 1 in the models with self-reported travel times. In contrast, subjects reliability ratio is smaller than 1 in the models with travel times as measured by GPS devices.

Number of Subjects		39	
		Sample	Twin Cities
Sex	Male	46.15%	49.40%
	Female	53.85%	50.60%
Age (Mean, Std. Deviation)		(50.44, 10.81)	(34.47, 20.9)
Education	11th grade or less	0.00%	9.40%
	High School	17.95%	49.60%
	Associate	15.38%	7.70%
	Bachelors	61.54%	23.20%
	Graduate or Professional	5.12%	10.10%
Household Income	$49,999 or less	23.08%	45.20%
	$50,000 to $74,999	20.51%	23.30%
	$75,000 to $99,999	25.64%	14.60%
	$100,000 to $149,999	23.07%	11.00%
	$150,000 or more	7.69%	5.90%
Race	Black/African American	7.69%	6.20%
	White or Caucasian	79.49%	87.70%
	Others	12.81%	6.10%

Minneapolis' Population statistics are obtained from the (50)





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Objectives

Understand the influence of perception error on the Reliability Ratio.

Compare confidence intervals of reliability ratio with travel times from GPS data, and travel times from Survey data.

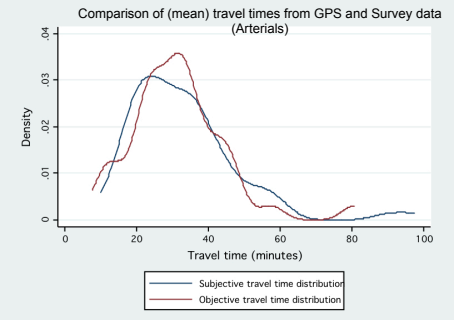
Data

GPS : 39 subjects following no instruction from researchers in a period of 8 to 13 weeks.

Electronic Survey : Comprehensive evaluation of bridge alternatives by the 39 subjects.

Variables	Survey (Mean/SD)	Survey (Mean/DMP90)	Survey (Median/SD)	Survey (Median/DMP90)	GPS (Mean/SD)	GPS (Mean/DMP90)	GPS (Median/SD)	GPS (Median/DMP90)
	Estimates (T-Stats)	Estimates (T-Stats)	Estimates (T-Stats)	Estimates (T-Stats)	Estimates (T-Stats)	Estimates (T-Stats)	Estimates (T-Stats)	Estimates (T-Stats)
Centrality - Travel time - [Interstate/nonInterstate]	-1.19 (-2.89) ***	-0.66 (-3.72) ***	-1.20 (-2.90) ***	-0.70 (-3.56) ***	-0.33 (-3.88) ***	-0.31 (-3.86) ***	-0.19 (-3.39) ***	-0.17 (-3.31) ***
Dispersion - Travel time - [Interstate/nonInterstate]	-1.54 (-2.89) ***	-0.38 (-3.41) ***	-1.93 (-3.05) ***	-0.61 (-3.71) ***	-0.14 (-3.01) ***	-0.12 (-2.75) ***	-0.15 (-3.41) ***	-0.11 (-2.91) ***
Gender - [nonInterstate] 1 = Male; 0 = Female	1.25 (0.85)	1.54 (0.103)	2.02 (1.46)	1.84 (1.69) *	-0.54 (-0.75)	0.25 (0.52)	0.09 (0.14)	0.55 (0.94)
Income - [nonInterstate] [$20, 000, $74, 999] 1 = In; 0 = Out	1.32 (0.76)	0.400 (0.36)	0.66 (0.42)	0.05 (0.04)	0.68 (0.71)	-0.13 (-0.14)	-0.39 (0.44)	-0.63 (-0.78)
Income - [nonInterstate] [$75, 000, $99, 999] 1 = In; 0 = Out	1.52 (0.86)	-0.042 (-0.04)	0.66 (0.42)	-0.29 (-0.26)	0.14 (0.14)	-0.80 (-.78)	-0.27 (-0.31)	-0.79 (-0.92)
Income - [nonInterstate] [$100, 000, ∞.+] 1 = In; 0 = Out	-1.75 (-0.77)	-1.03 (-0.89)	-3.73 (-1.65) *	-1.66 (-1.16)	1.07 (1.17)	0.25 (0.30)	0.08 (0.10)	-0.32 (-0.43)
Type of work trip - [nonInterstate] 1 = from home to work; 0 = from work to home.	-0.19 (-0.14)	0.49 (0.62)	0.29 (0.80)	0.75 (0.80)	-0.29 (-1.37)	0.35 (0.52)	-0.16 (-0.28)	0.31
Alternative Specific Constant - [nonInterstate]	-2.07 (-1.13)	-2.02 (-1.86) *	-2.04 (-1.48)	-2.35 (-1.85) *	-1.03 (-1.37)	-1.20 (-1.66) *	-0.22 (-0.31)	-0.60 (-0.90)
Reliability Ratio RR	1.30	0.83	1.60	1.14	0.42	0.39	0.77	0.65
95% Confidence Interval	[1.08, 1.51]	[0.59, 1.08]	[1.32, 1.89]	[0.95, 1.35]	[0.18, 0.69]	[0.16, 0.61]	[0.37, 1.16]	[0.28, 1.02]
Intercept Log-Likelihood $\ell_{(K)}$	-51.472515	-51.472515	-51.472515	-51.472515	-51.472515	-51.472515	-51.472515	-51.472515
Final Log-Likelihood ℓ_{β}	-9.4065462	-22.884538	-10.486297	-18.352769	-30.111183	-31.944981	-36.652578	-39.258894
Likelihood ratio index ρ^2	0.81725109	0.55540276	0.79627086	0.64344525	0.41500663	0.37937789	0.28789942	0.23728433
Akaike Information Criterion AIC	34.81309	61.76908	36.97259	52.70554	76.22237	79.88996	89.30516	94.51779
Bayesian Information Criterion BIC	59.21194	86.16792	61.37144	77.10439	100.6212	104.2888	113.704	118.9166
Number of observations	78	78	78	78	78	78	78	78
Number of subjects	39	39	39	39	39	39	39	39

* is 10% significance level, ** is 5% significance level, *** is 1% significance level



Conclusions

This study presents novel results that are starting to scratch the surface of the influence of perception on the valuation of travel time. At the moment, there is none to little effort in favor of intersecting two main research areas in the transportation literature: travelers' perception of travel time; and travelers' valuation of travel time with a greater emphasis on the valuation of travel time reliability. There are already several studies identifying that subjects' perception of travel times has been found to be a significant factor in studies. Travelers overestimate or underestimate the actual travel times they experience. Therefore, it is likely that revealed preference studies may be underestimating or overestimating the value of travel time savings, and value of travel time reliability as the objective travel time distributions (measured from devices) differ from the subjective travel time distributions (self reported by travelers).

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